IOT based Hydration Monitoring System

Group Members:

Abhinav Choudhary (15B00293)

Agrima Soni (15B00297)

Prashant Pandey (15B00331)

Hitesh Goel (15B00311)

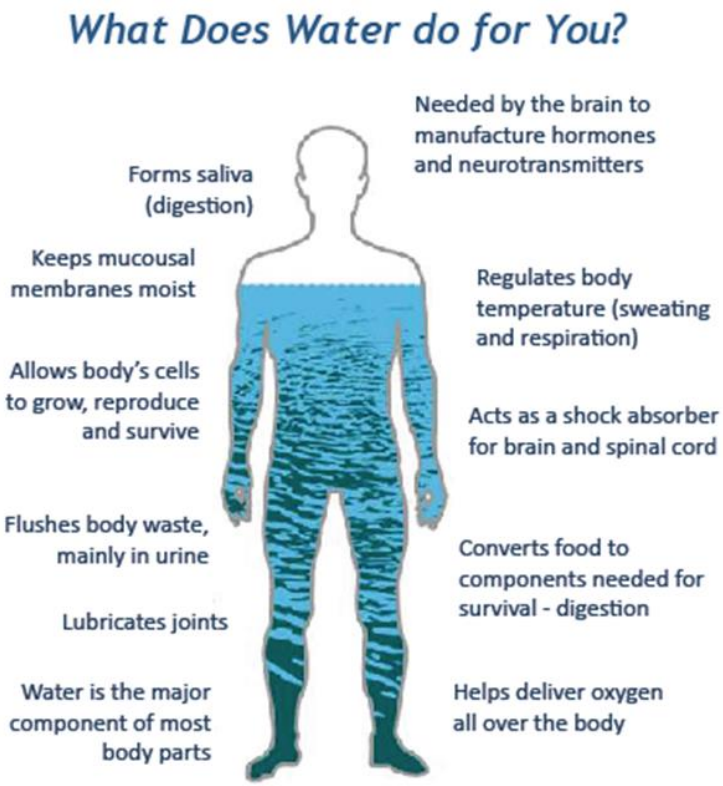
Akshat Bhandari (15B00298)

INTRODUCTION

With two thirds of the earth's surface being covered by water and the human body of an average adult consisting of 60 percent of it, it is henceforth clear that water is one of the prime elements responsible for life on earth. It has been found that, drinking 2 L in one day can increase energy by about 96 calories. Also, the body metabolism levels up by 24-30% with intake of 500 ml of water. Less intake of water may lead to thirst, tiredness, headache and a decrease in alertness, concentration and memory as well as loss of endurance. To be precise, men needs roughly about 13 cups (3 liters) of total beverages a day. The AI (Adequate intake) for women is about 9 cups (2.2 liters) of total beverages a day. Water can be found in mainly these 3 locations in our body:

- Within our cells
- In our Blood
- In the space between our cells

Our project is an attempt to provide the solution by developing a device using IOT which will give the Real time analysis and recommendations of water content in human body. The product will be portable and can be used by any section of society. The monitoring of data will be achieved by wirelessly sending sensor data to an open source Platform.



MOTIVATION

Due to the Ongoing Summer Season, Dehydration is the major concern for the health nowadays. People aren't aware of the diseases which are caused due to less water content in the body. Unfortunately, they doesn't consider water consumption as a major concern for their health. People prefer other liquids instead of water, but as per the researches, it doesn't compensate the need of water, in a human body. No product as of now is available to check, analysis and recommend the water level in the human body. Hence, we took an initiative to serve the society by solving a real life body problem and thus, innovating a tool which will analysis and recommend the level of water in our body.

RESEARCH

FACTORS AFFECTING HYDRATION

There are many factors that influence the amount of fluid an individual needs before, during and after physical activity. The factors can be broken down into two major categories; physiological factors and environmental factors. Physiological factors include height, weight, body composition, genetic predisposition and metabolic rate, along with level of conditioning

and current hydration status. Environmental factors include exercise intensity and duration, environmental condition.

The above mentioned factors determine an individual's sweat rate and electrolyte loss during an activity. The amount, an individual sweats during activity determines their fluid needs. The American College of Sports Medicine suggests to consume 0.6-1.2 liters of fluid per hour of exercise.

Therefore, it is important for physically active individuals to be aware of how much they are sweating. It is easy to become mildly dehydrated.

Physiological Factors Affecting Hydration

Hydration depends upon an individual's physiology (Height, Weight, Body Composition, Genetic Predisposition and Metabolic Rate). An individual's height, weight, body composition, genetic predisposition and metabolic rate affects the amount of fluid taken to maintain a constant core temperature. Sweating occurs during activity in order to dissipate heat and maintain a constant internal core temperature (98.6^{o} F).

Henceforth, from the above mentioned factors determines the need of fluid while performing a Physical activity. Also, Hydration helps in maintain Blood volume, hereby aiding to cool the body efficiently.

Level of Hydration

Water serves many important functions in the human body. If an individual is dehydrated prior to exercising; the body will try to conserve fluid. Individuals that are dehydrated sweat less and less as activity continues and dehydration becomes more severe. This is very dangerous and can even be fatal. The signs and symptoms of dehydration will start to take effect quickly.

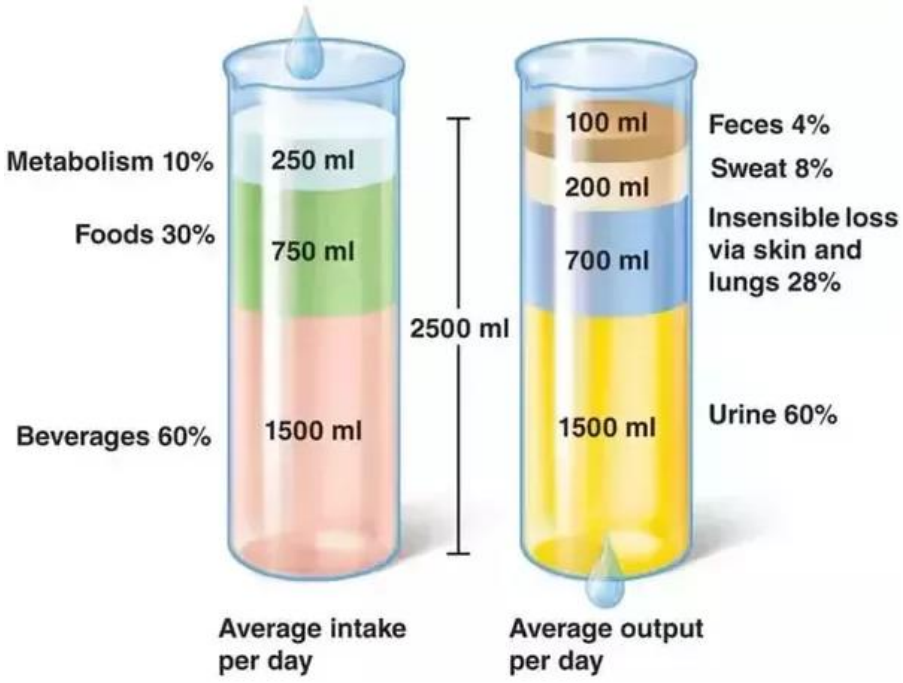
Effects of Dehydration

Percent Dehydration	Pounds lost for 150-pound person	Effect
1	1.5	Increased body temperature
3	4.5	Impaired performance
5	7.5	Heat cramps, chills, nausea, clammy skin, rapid pulse, 20-30% decrease in endurance capacity
6-10	9-15	Gastrointestinal problems, heat exhaustion, dizziness, headache, dry mouth, fatigue
>10	>15	Heat stroke, hallucinations, no sweat or urine, swollen tongue, high body temperature, unsteady walk

Environment Factors Affecting Hydration

Hydration varies with the temperature and the level of humidity in the air. When physical activities are done in a hot and humid environment, the body is placed under a large amount of physiological stress. Both the skin and the muscles require blood flow, which is limited. In turn, the cardiovascular system is forced to respond in an attempt to meet the increased demands. The cardiovascular system can quickly become overwhelmed during these times of physiological stress; resulting in negative and/or dangerous physiological effects. These effects are commonly called heat stress, heat exhaustion and heat stroke. Staying properly hydrated during activity can help prevent heat illness.

If an individual has been training in a specific environment their body will be more efficient during physical activity. If an individual is not acclimated to that environment, in many cases, their fluid needs increase due to lack of efficiency.



The Influence of Hydration on Heart Rate

- Results have shown that for every 1% decrease in body mass during exercise in the heat, there is an increase in heart rate of about 3.29 beats/min. This equates to an increase in heart rate of 10 beats/min if an athlete is 3% dehydrated.
- Exercise at a fixed and variable intensity has shown an increase in heart rate of 3.55 and 1.39 beats/min respectively during exercise in the heat.
- Body mass losses as small as 2% have been shown to result in an increase in cardiovascular strain and subsequently decrease performance during exercise. Exercise

in the heat further exacerbates cardiovascular strain, thus causing further decrements in performance.

HARDWARE REQUIREMENTS

- Heart rate sensor: KG011 sensor
- GSM Shield
- Intel Galileo Gen2 Board
- Breadboard
- SD Card
- Card Reader

RESULT COMPARISON WITH OTHER IOT PROJECTS

Heart Rate monitoring comparison with “An Intelligent Sensor Based System for Real Time Heart Rate Monitoring (HRM)” by “Nusrat Jahan Farin, S. M. A. Sharif, Iftekharul Mobin”.

To determine whether the proposed prototype work perfectly or not 5 person were selected to take their heart rate from the finger of the hand. This study measure the idle heart rate for each of the monitoring people and compare their further heart rate with the idle one and make an alert in the abnormalities. Though all the sampling people are almost healthy so in the experimental time it does not need to make any alert. The aim of this experiment is to determine whether the system work perfectly or not. For the proposed prototype we take 5 person for the experiment. We find different types of heart rate data for different people. Each and every time our prototype can able to determine the idle heart rate and also can compare the heart rate with the idle one.

Temperature and Humidity comparison by “Real Time Remote Temperature & Humidity Monitoring Using Arduino and Xbee S2” by “Vijay S. Kale, Rohit D. Kulkarni”

The measurement of humidity and temperature were carried out during summer in the state of Haryana (India) at Gurgaon (28.4595° N, 77.0266° E).Two sets of readings one for the night on dated 04-05-2017 and the other for the day on dated 05-05-2017 were taken.

CODE OF THE PROJECT

```
int PulseSensorPurplePin = 0;

int LED13 = 13;

int Signal;

int Threshold = 570;

int count = 0;
```

```
int value = 0;
int heartbeat = 0;
int j = 0;
#include <SPI.h>
#include<SD.h>
int sign;
void setup() {
  // put your setup code here, to run once:
  Serial1.begin(115200);
  Serial.begin(9600);
  pinMode(LED13, OUTPUT);
  Serial.print("Initialising SD Card...");
  Serial.println("Card intitialized");
  system("/sbin/fdidk -1 > /dev/ttyGSO");
  system("date 2017.05.17-10:00::35");
}

void loop() {
  //  // put your main code here, to run repeatedly:
  if (value < 30000) {
    value += 300;
    Signal = analogRead(PulseSensorPurplePin);
    if (Signal > Threshold && Signal < 700) {
      digitalWrite(LED13, HIGH);
      count = count + 1;
```

```
    Serial.print(count);
    Serial.print("     Signal value    ");
    Serial.println(Signal);
   }
   else {
    digitalWrite(LED13, LOW);
   }
 }
 if (value >= 30000) {
   heartbeat = count * 2;
   value = 0;
   count = 0;
   Serial.println(heartbeat);
   String datastring = "";
   system("date '+%H:%M:%S' > /home/root/time.txt");
   FILE *fp;
   fp = fopen("/home/root/time.txt", "r");
   char buf[20];
   fgets(buf, 9, fp);
   fclose(fp);
   datastring += String(buf) + ",";
   String phour, pminute;
   int i = 0;
   for (i = 0; i < 2; i++) {
    phour += buf[i];
```

```
  pminute += buf[i + 3];
}
int presenthour = phour.toInt();
int presentminute = pminute.toInt();
datastring += String(heartbeat);
File datafile = SD.open("heart.csv", FILE_WRITE);
if (datafile) {
  datafile.println(datastring);
  datafile.close();
}
else {
  Serial.println("error opening heart.csv");
}
j++;
if (j==10) {
  datafile = SD.open("heart.csv");
  if (datafile) {
    while (datafile.available()) {
      String s = datafile.readStringUntil('\n');
      int hour = s.substring(0, 2).toInt();
      int minute = s.substring(3, 5).toInt();
      if ((hour==presenthour-1)&&(minute==presentmiute)) {
        int lastheart =  s.substring(10).toInt();
        j = 0;
        if (lastheart<heartbeat-8) {
```

```
            Serial1.println("ATD +918607442065;");//dial the number
            delay(100);
            Serial1.println();
            DialVoiceCall();
           } else
            break;


         }
        }
        datafile.close();
      }
      else {
        Serial.println("error opening heart.csv");
      }
    }
  }

  delay(300);
}
void DialVoiceCall()
{
  Serial1.println("ATD +918607442065;");//dial the number
  delay(100);
  Serial1.println();
```

```
}

void ShowSerialData()

{

  while (Serial1.available() != 0)

    Serial.write(Serial1.read());

}
```

STEPS TO RUN THE PROJECT ON HARDWARE

- Connect the whole circuit.
- Connect the completed circuit with the device in which you want to show the data i.e. laptop or computer.
- Start the Intel Galileo board.
- Make sure that the pulse sensor is not exposed to any external light, so to prevent it from false reading you can cover the sensor with any black wrapper.
- Touch the sensor with your finger and run the Arduino software in your device.
- After running the code in Arduino, the sensor will calculate your heartbeat and it will show the result on screen.

FUTURE SCOPE

In this paper we deal with the numeric data which is found from our experiment that helps to detect the health condition as well as heart rate. We can co-relate the sensor data with the real patient's data which will help us to compare the real scenario. In future we can add some other features to develop the system and make it easy to user through smart application. This system can be incorporated with cloud computing and enriched the prototype system.